THE

VETERINARY JOURNAL

Editor :

FREDERICK HOBDAY, C.M.G., F.R.C.V.S., F.R.S.E.,
HONORARY VETERINARY SURGEON TO HIS MAJESTY THE KING.
OFFICIER DU MERITE AGRICOLE (FRANCE).
CAVALIERE DEI S. S. MAURIZIO E LAZZARO (ITALY).
HONORARY MEMBER OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION.
AND FORMERLY PROFESSOR IN THE ROYAL VETERINARY COLLEGE, LONDON

Sub-Editor :

GLADSTONE MAYALL, M.R.C.V.S.

OCTOBER, 1922.

Obituary.

THE LATE MR. FRANK GARNETT, C.B.E., J.P., M.R.C.V.S.

THE unexpected news of the sudden death of Mr. Frank Garnett, the late President of the Royal College of Veterinary Surgeons, who piloted the ship safely through the troubled waters during the war years from 1914 to 1919, came as a shock to everybody in the profession. A strong personality, a man with a reputation for justice and fair dealing, generous-hearted, and full of energy and business tact, Mr. Garnett gained the confidence of his colleagues both on the Council and throughout the profession, being elected again and again by them for five successive years. His experience during those years was unique, for they included the Jubilee Meeting of the International Veterinary Congress, the years of war and all its additional anxieties, the piloting of the Veterinary Surgeons' Amendment Bill, and a score of other things which in normal times would not occur. It was fortunate that the affairs of the College Council were at that time in the hands, too, of a man who was willing and able to give up his time, even to the extent of relinquishing his practice, to its duties ; for the exigencies of the times demanded very great personal sacrifice from everybody, and what Mr. Garnett did, he did voluntarily and willingly. No one will ever know what he really did give up for the

sake of his profession, both monetarily and otherwise, and the C.B.E. awarded to him by the Government was well and worthily earned.

It was not only in his beloved profession, however, that his talents came out, for, as an author, his book on "Westmorland Agriculture, 1800-1900" is a standard authority, and its pages show a wide and broad-minded knowledge of the subject. By way of illustrating his versatility and popularity in totally opposite spheres, one notes that the National Pony Society elected him to their Council, as did also the Westmorland War Relief Committee, whilst for many years he held the honour of being a magistrate in his county. Harking back, even in his student days Frank Garnett was marked down as a leader of men, and those who were with him at the London College will recollect his association with Gilruth and Dr. Macdonald in the formation of the Students' Union, which did so much to rectify the grievances of the students and bring about better social conditions and a better state of amenity between their teachers and themselves.

His life throughout was spent in the betterment of the profession; and his early death, just in the prime of life and mature judgment, has deprived us of a leader whose steadying influence will be missed by Council and practitioners alike. He died literally as he would have wished, "in harness," and we feel sure that we are echoing the wish of the whole profession when we say their deepest sympathy is extended to his family and relatives in their great loss.

Editorials.

WHOLE-TIME SALARIES AND THE VALUE OF LOYAL CO-OPERATION.

THE British Medical Association has again demonstrated the value of its existence as a power for good in regard to its individual members and the profession in general, and it is time that we of the veterinary profession awakened to the fact that we, too, might do the same if only we acted up to our motto of *Vis Unita Fortior*, and, to a man, backed up our own National Veterinary Association with unswerving loyalty.

It is true that the total number of members of the B.M.A. on September 12, 1922, was 24,140, and that we do not yet number 2,000, but in regard to the number of positions offered, the proportion of applicants in the two professions is much about the same, except that by stupidly rushing for the small and inadequately salaried posts,

the younger graduates in our branch are rather more thoughtless. Even for the miserable pittance of £200 a year offered by our Government Department, there seems to be no difficulty about obtaining qualified men whose professional education has taken four, and in some instances five, years of hard study. No wonder we are slighted and have difficulty in making our value recognised! Let us carefully consider the following extract from the *British Medical Journal* and apply it to ourselves when similarly situated. It demonstrates the power of cohesion, and our underpaid younger graduates ought at least to loyally support the efforts of the Salaries Committee of the National Veterinary Association to obtain what is, after all, as food and rents stand nowadays, barely a living wage. If a medical whole-time official is dissatisfied with a commencing salary of £700 a year, how much more ought the veterinary whole-time official (who has just as good a social position to keep up) to be dissatisfied with a miserable £200? What can he save out of it? He can barely exist. A chauffeur is much better off both as regards pay and the position he has to keep up.

THE REMUNERATION OF A TUBERCULOSIS OFFICER.

In 1912 the Plymouth Borough Council appointed a tuberculosis officer at a salary of £500 per annum. In 1922 this officer informed the British Medical Association that his salary was still unchanged, and that he had not even been granted a war bonus. His case was taken up by the Plymouth Division and local efforts were supported by representations from the Head Office. In June last the Medical Secretary wrote remonstrating with the Council on its treatment of the tuberculosis officer, pointing out that £500 a year was inadequate remuneration for a man who acted as a consultant and expert in tuberculosis, and adding that if this officer were to resign and a new appointment had to be made, it was unlikely that they would get anyone to replace him for less than £700 a year. that being the minimum recognised by the Association. It is satisfactory to be able to announce now the following readjustment of this officer's salary:

From April 1, 1920, to March 31, 1921, to £600.
From April 1, 1921, to March 31st, 1922, to £650.
From April 1, 1922, to March 31, 1923, to £700.
and after March 31, 1923, to £750 per annum maximum.

For an experienced officer who has been for ten years with one Authority a maximum salary of £750 is little enough, but the increase is a move in the right direction. The assistance given by the Association has been cordially acknowledged.

The matter lies with ourselves. We certainly cannot be dispensed with, and we also most certainly cannot take up our proper position

professionally on £200 a year. Let us copy the example set by our medical *confreres* and adopt the trade union principles which they have adopted ; by being loyal to the standard of salary set out by the Salaries Committee of the N.V.A. as the minimum which should be accepted, the individual will certainly benefit. In addition to that, the whole tone of the profession will be maintained ; for it is by external appearances quite as much as by the result of good work done that the general public take their cue and make their criticism.

THE MODEL ABATTOIR SOCIETY.

THE " Sir Benjamin Ward Richardson " Memorial Lecture, under the auspices of The Model Abattoir Society, will be delivered on October 12, in the Barnes Hall of the Royal Society of Medicine by Sir Wm. Collins, K.C.V.O., F.R.C.S., and members of the Veterinary profession are invited to attend. The chair will be occupied by the President of the Society, Sir James Crichton Browne, who will be supported by a number of those known in connection with movements for justice and humanity towards animals, and for promoting purity of food supplies.

The Society was founded by Sir Benjamin Richardson, whose paper, written some fifty years ago, on " Researches into a Practical Method of Killing Animals intended for Human Consumption without the infliction of Pain " is still of standard value ; and whose investigations led to the practical form of lethal chamber the principle of which is still carried out in many of our dogs' homes and other such like philanthropic institutions. It was always his keen desire to discover some practical method whereby animals intended for human food consumption could be humanely narcotised before being actually despatched, and perhaps the time may come when that may be possible.

The objects of The Model Abattoir Society are :

(*a*) To induce the public to insist on the erection of public abattoirs in all places where they do not already exist, so that the private slaughter-house system generally may be abolished.

(*b*) To demonstrate the healthiest, the most convenient, the most humane, and from all practical points of view, the best lairage for animals that are waiting to be slaughtered.

(*c*) To illustrate and teach the most rapid, skilled, and humane methods of slaughtering all kinds of animals intended for human food.

(*d*) To bring into practical working every improved method for dressing and preserving the carcases of animals, so that the flesh may enter the market in the best condition.

(*e*) To show the importance of providing slaughterers with proper

conveniences for washing and cleaning themselves, the necessity of lavatories, and abundant hot and cold water supply.

(*f*) To promote the most complete method for the quick removal from the slaughter-house of offal, blood, and other refuse, which undergoes rapid decomposition.

(*g*) To insist on the necessity of a systematic and scientific inspection of all animals for food, and to induce local authorities to form a staff of competent inspectors for that purpose, so that no meat shall enter the market carrying with it the taint of disease.

(*h*) To advocate the best means of warming, ventilating, cleansing, and draining the Abattoir and lair connected with it.

(*i*) To advocate improvements in places where the meat is stored after being dressed, and the best method of keeping it in a satisfactory condition.

The Society is doing good work in continually ventilating the subject before the professional and lay public, and is very emphatically in accord with the Veterinary profession in the desire to abolish what it is pleased to term "The Dark Continent" of private slaughter-house methods, and to substitute in its place the Model Public Abattoir, in which both killing and the subsequent inspection can be properly carried out under the supervision of the skilled expert—and for that purpose there is really only one—the trained veterinarian. For this reason, to look after what is our proper right, if for no other, we ought to endeavour to attend the meeting, and thus show that we support the aims and objects of the Society.

General Articles.

THIRD INTERNATIONAL CONGRESS OF THE HISTORY OF MEDICINE, LONDON, 1922.

THE HISTORY OF VETERINARY ANATOMY IN ENGLAND DURING THE SIXTEENTH, SEVENTEENTH, AND EIGHTEENTH CENTURIES.

By Major-General Sir FREDERICK SMITH, K.C.M.G., C.B., F.R.C.V.S.

The history of veterinary anatomy in England during the sixteenth, seventeenth, and eighteenth centuries is, on the whole, a dismal record; little desire was shown for exact information on any matter connected with the veterinary art; but of far greater importance was the fact that no veterinary school existed in this country until the closing years of the eighteenth century. In spite of this it is remarkable that enthusiasts, generally laymen, were found in each century

who endeavoured to supply information on the subject of disease. As their apology for appearing in print, they all profess a love of their country, and in some cases this was no doubt genuine. Their besetting sin was their absence of originality; with a few exceptions they copied each other, and perpetuated the same ignorant statements from century to century.

I have chosen to begin with the sixteenth century for the reason that, prior to the middle of that period, the veterinary art in England belonged to the dark ages. In the seventh year of the reign of Queen Elizabeth (1565) Thomas Blundeville, a country gentleman and scholar, whose natural bent was towards mathematics, navigation, and astronomy, produced the first veterinary work published in this country. It represented several years of labour; on the scientific side he had little to guide him but the surviving fragments of knowledge belonging to Greece and Rome. On the clinical side he was almost entirely dependent on the Veterinarian of the Court of Queen Elizabeth; he himself brought no personal knowledge to his task, and had to rely upon his own logical and exact mind for sifting the matter he collected.

The anatomical part of his work is quite the worst. He never dissected; he may have seen post-mortem examinations, though they are never referred to by him, but he amply recognised the importance of anatomy as a basic subject, and he promised that if in the future he had leisure and time he would publish a "perfect anatomy" of the horse. This work unfortunately never materialised. He urged the practitioners of his day to "diligently search" for themselves; to dissect and apply practically the knowledge thus gained. Meanwhile, he informs them, they must be content with a brief description of the "sinews," veins and bones only, which he has translated for their use from Vegetius. As a matter of fact, there is no part of Vegetius which is so obscure or badly done as the fourth book, dealing with anatomy, and the information which Blundeville told his readers to be temporarily contented with is of the most hopeless and worthless character.

When it is remembered that the dissection of animals formed the only anatomical training of students of medicine from ancient days to the fifteenth century, it is astonishing that so few anatomical observations have survived. In order to understand Blundeville's position in 1565, we must glance at the then available anatomical knowledge of animals.

Besides the numerous references to General Anatomy, Aristotle refers to the special anatomy of the stomach of ruminants; there is also a reference to the stomach of the pig, but the remarkable stomach

of the horse escapes mention. Yet he examined the horse, for he notes the absence of a gall bladder in that animal. Aristotle refers to the small and large intestines; he compares the lobulated kidney of the bovine with the plain kidney of other animals; the generative organs are dealt with somewhat more fully. Varro and Columella, writers on veterinary subjects just before and immediately after the beginning of the Christian era, tell us nothing of anatomy. Pliny, a contemporary of Columella, merely repeats Aristotle. Galen, a

FIG. 1.—A Dissection of the Horse.
G. B. Ferraro, 1560.

century later, describes the brain of the ox, with its remarkable vascular network; also the stomach of ruminants, the seventh muscle of the eye of quadrupeds, and the bony ring in the heart of the horse, but nothing more of the special anatomy of animals appears to have survived.

In the fourth or fifth century of our era lived Vegetius. He certainly never handled a scalpel and probably never saw a post-

mortem examination. A soldier by profession, and enthusiast in veterinary matters by inclination, he set to work, as Blundeville did over a thousand years later, to collect information from all quarters bearing on the diseases of animals, with the avowed object of elevating a degraded profession. Vegetius derived his information from the Greek writers of his period and of the preceding centuries, but the source of his contributions to the anatomy of the horse is unknown. In the literature to which he had access, fragments of which, known as the Hippiatrika, have been handed down to us, there is no reference to anatomy.

The School of Salerno must have had many manuscripts dealing with the anatomy of animals, but only one, a thirteenth-century work on the anatomy of the pig, has survived, and was printed in Venice in 1502.* An Arabic treatise on the horse, belonging to the twelfth or thirteenth century, known as "El Naceri"† gives a short anatomical description of the bones and articulations; it also mentions that, exclusive of the finer vessels, there are 362 blood vessels in the animal. In the fourteenth century a German veterinarian named Mauro, in a work dealing with diseases, gave an account of the principles of veterinary anatomy with illustrations.‡ In 1499 Leonardo da Vinci completed his long anatomical study of the horse in connection with the Sforza statue. So far as an examination of his papers reveals, he confined himself to surface anatomy and measurements; there is nothing to show that even the skin was removed.

In 1490 Agustino Columbre, a veterinarian of San Severo, introduced a little anatomy into his work on diseases. In the main he followed Vegetius. About 1560, G. B. Ferraro, one of the most celebrated members of the Neapolitan School of Horsemanship, published a treatise on diseases in which he gave the proportions of the body such as would be suitable for artistic purposes, together with rough cuts showing the contents of the abdominal cavity, a dissection of the limbs, and a very poor drawing of a horse's skeleton, which closely resembles that of a cat. (Figs. 1 and 2.)

The anatomy of Fallopius, published in 1561, and that of Eustachius in 1563, contained information which Blundeville might have embodied. We have now reached his period; he tells us nothing of the viscera of the horse, but confines himself to osteology, "sinews," and veins. It is true that the material at his disposal was very limited, but it is difficult to excuse his going back a thousand years to the corrupt text of Vegetius for information. The following is what he learnt of anatomy from that source:—

---

* The authority is L. Moulé. I have not seen the work.
† This book was translated by N. Perron and printed in Paris in 1852.
‡ L. Moulé is the authority. I have not seen the work.

The head is described as consisting of four bones, the lower jaw of two, and the number of teeth forty. Vegetius gives no further information of this region.

The number of vertebræ in the neck is correctly stated, but eight bones are said to comprise the back, seven the loins and sacrum, and twelve the tail. There is nothing in Blundeville's text to show that he was surprised that there should be more bones in the tail than in the back. The bones of the fore limb are more correctly enumerated, but in the hind limbs there are some singular errors. The total number of ribs is correctly stated, which is rather remarkable considering the dorsal vertebræ were so badly done. The total number of bones in the body is stated to be 170. There is nothing further on osteology.

The muscular system is not touched upon by Vegetius, and the "sinews" described belong more to the nervous than the locomotor

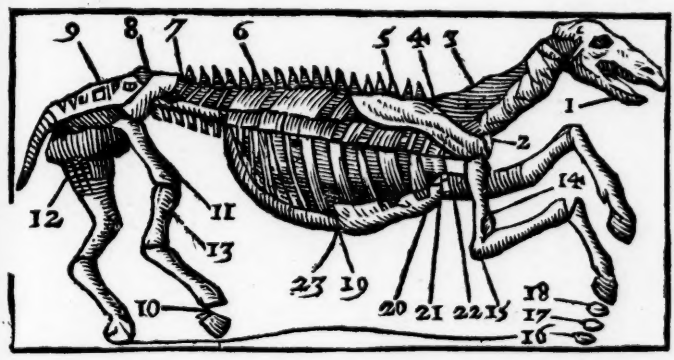


Fig. 2.—Skeleton of the Horse. G. B. Ferraro, 1560.

system. We are informed that two sinews run from the nostrils up the face, along the neck, to the end of the tail. The length of this double cord is said to be twelve feet. Two branches or principal "sinews" of the brain are described as four feet in length. Two sinews are described as running from the shoulders to the knee, and from here four run to the foot. Ten sinews are said to exist in the fore legs, ten in the hind, and four run from the kidneys to the testicles. The total number of sinews in the body is given as thirty-four. An attempt was made by Vegetius to enumerate the veins, apparently only those likely to be utilised for "bleeding" being dealt with; the total number given is twenty-nine.

Such was the anatomical nonsense which Blundeville presented to his readers; it would have been a simple matter for him to have put some of this anatomy to a practical test, and it is difficult to under-

stand, considering his enquiring mind, why he did not do so. However, he made one contribution to anatomy; he doubted the existence of a brain in the horse, saying that it had either very little or none. He made no attempt to prove this extraordinary statement, which for years was accepted by the ignorant.

After Blundeville, the next writer in this country was Leonard Mascall, a layman and unscrupulous plagiarist, who in 1587 compiled a work on the diseases of animals. Mascall's anatomical contribution was to embellish Blundeville's doubts regarding the existence of a brain by making the positive statement that the horse had no brain, but that in its place was a bladder filled with wind and "white water." A physiological contribution which would require a great deal of beating was the statement that the goat breathes through its ears!

In 1591 P. Scacco, a veterinarian of Tagliacozzo, published in

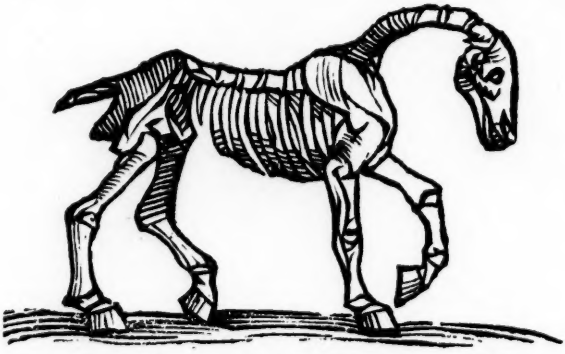


FIG. 3.—SKELETON OF THE HORSE. Scacco, 1591.

Rome a work on the diseases of the horse. A brief anatomical description of the animal was given, together with a figure of the skeleton, which is reproduced, Fig. 3. This is a good index to the anatomical knowledge of the veterinarians of the period.

In 1598 appeared "The Anatomy of the Horse," by Carlo Ruini, of Bologna. Ruini was a senator of that city, a lawyer and veterinarian. He may not have practised, but he studied and wrote on the diseases of the horse, and the volume preliminary to that on diseases is entirely devoted to the subject of anatomy. Ruini's anatomy is startling in its originality and truthfulness; all the old Galenical nonsense is scrapped; he dissected the animal for himself, having doubtless been fortified by a course of instruction in the medical school. The work is accordingly original, astonishingly advanced, and is illustrated by many admirable drawings (Figs. 4 and 5). The

publication of this remarkable work redeemed the sixteenth century from failure, and transported veterinary anatomy from the depths of ignorance to a position which, I think, may be claimed as nearly equal to that occupied by human anatomy at that period. Ruini was the father of equine anatomy. It is interesting to note that his work was produced during the lifetime of Blundeville, to whom, if he saw it, it must have been a revelation.

Ruini divided his anatomy into five books ; the heart and brain, the neck and chest, the abdomen and pelvis, the generative organs, including the fœtus and its envelopes, and finally, the limbs and foot. In each region he begins with the deep structures, and works to the

FIG. 4. - MUSCLES, NERVES AND VESSELS OF THE HEAD.
C. Ruini, 1598.

surface. The muscles are not named, but receive a number, for example, " the third muscle of the pastern," and in dealing with the small bones of the carpus and tarsus, numbers and not names are allotted them. Curiously enough, he describes the first ribs as clavicles, which led his copyists into an error. He failed to describe the peculiar arrangement of the mucous membrane of the stomach of the horse. The anatomy of the foot, so important clinically, is imperfectly dealt with. He was the first to describe the second dentition of the first three molars.

It is a remarkable fact that this epoch-making book appears

to have escaped historians. Portal scarcely notices it, and even to-day Ruini is practically unknown to anatomists. Yet in this book Ruini also dealt with the circulation of the blood ; his writings show that the germ of the conception of the circulation was known to him. It is impossible to believe that a work in which the circulation of the blood is dealt with, published in Italy the same year that Harvey went to Padua, could have escaped that great man's notice.* The attitude of Ruini towards veterinary anatomy was identical with that of Vesalius ; he threw overboard without the slightest hesitation the accepted notions of the past, and by the diligent application of his scalpel built up a new art and revolutionised veterinary knowledge. He further resembled Vesalius in meeting with no recognition ; this may partly be accounted for by the fact that his book was not published

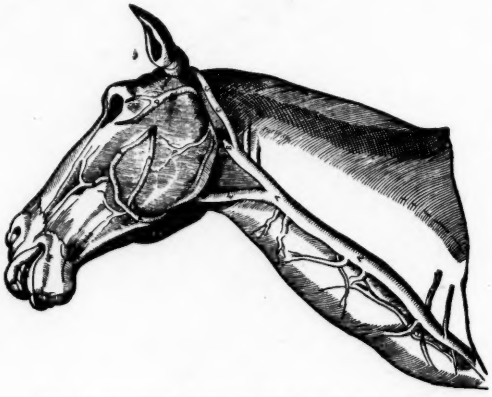


FIG. 5. · VENOUS SYSTEM OF THE HEAD AND NECK.
C. Ruini, 1598.

until the year after his death. Is it too late, 324 years after Ruini's death, to accord to this great man the credit which is his ?

The year following that in which Ruini's work appeared, Jean Héroard, Court Physician in Paris, published in 1599 his " Osteology of the Horse " ; the letterpress is brief, but accurate, and several beautifully executed plates accompanied the text.

The seventeenth century brought to the front in England a man of very different stamp from Blundeville and Ruini. The name of

* Ruini was not the first veterinarian to deal with the circulation of the blood. In 1553 there was published at Sarragossa a work on the diseases of the horse by F. de la Reyna, which repeats the substance of Michael Servetus' views made public that year. A Spanish critic, Cazas de Mendoza, states, according to L. Moulé, that an edition of de la Reyna's work was published in 1532, in which case he anticipated Servetus by many years.

Gervase Markham became a common-place, and his malignant authority dominated veterinary thought for more than a century. Markham was a soldier, scholar, gentleman of fortune, minor poet, literary hack, and social parasite. He was a most versatile person, and wrote with facility and assurance on any subject. For reasons of pelf he chose during a long period of his life to write on veterinary matters, and to pose as a practitioner. He knew nothing of his subject, and was not only a mean plagiarist, but a violently untruthful man. He lived by his wits and scholarship, and some thirty-six first editions on various subjects represent his literary activities.

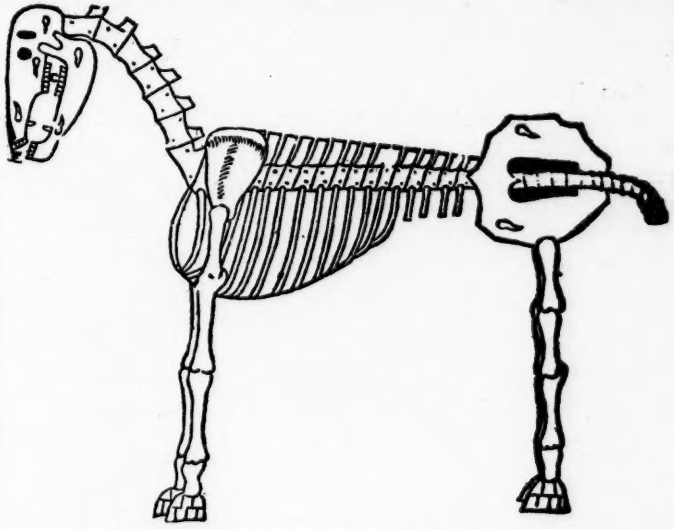


FIG. 6.—SKELETON OF THE HORSE.
Gervase Markham, 1610.

Markham published in 1607 a work entitled " Cavalarice " (The Horse Master), in which he refers to the anatomy of the horse, basing his statements on Vegetius. He says, however, that there is no sinew running from the nostrils to the tail, but that there is a main " sinew " which comes off from the brain and runs down the neck bones through every joint in the back. Opposite the shoulders two arms are given off from this sinew, which run down the fore legs, while three are given off in the pelvis, one to each hind leg, and the tail. Markham's main sinew is, of course, the spinal cord. In his numerous works during the next forty years he continued to describe the horse as possessing a gall bladder. Though he tells us he dissected, he says that the horse has no spleen, and that he could not find any definite evidence of the

existence of a brain ; nevertheless, he adds, as the result of conversation with learned men, he is convinced that a brain exists.

I have little doubt that Markham's teacher on this point was Sir Thomas Browne. The figure of the skeleton of the horse published in 1610 in his " Masterpiece " is eloquent testimony to the anatomical knowledge of Markham (see Fig. 6), and is on a par with everything he wrote on the veterinary art.* There is no excuse for his ignorance ; unlike Blundeville, he had Ruini to guide him. It is difficult to believe that this wretched impostor was a highly educated man.

In 1607 there was published in London, according to Arber, a work entitled " Three Anatomies of Horses Bodies, that it to say the Anatomy of the Vaynes, the Anatomy of the Boanes, and Synews." No author is mentioned, and I cannot trace the work, but the title suggests the fourth book of Vegetius.

In 1609 Nicholas Morgan, a barrister, published a work on Horsemanship, in which he combated the prevailing belief that the horse had no brain. Aldrovandi's compilation of the History of Quadrupeds, published at Padua in 1621, gives drawings of the fœtus of the cow, the uterus and cotyledons, but this subject, through the work of Fabricius, was now known. Between 1600 and 1618 Fabricius had described the fœtal envelopes of domesticated animals, together with an account of rumination, observations on the anatomy of the eye, ear, and larynx, together with an essay on the language of animals ; he rightly recognised that animals have some method by which they communicate. The work of Casserius contains many observations on veterinary anatomy and was available in 1600.

In 1622 Asselin discovered the chyle vessels in the dog, and in 1625 Germain François published a short anatomy of the dog and cat, together with plates.† In 1639 a layman, De Gray, published a veterinary work in London—a worthless composition—but he is indignant at the statement that the horse has no brain, and says he would be glad to demonstrate its existence. The anatomy of T. Bartholin, published in 1641, contains a large amount of veterinary information ; there are innumerable references to the anatomy of animals, many of which are illustrated. In 1645 Severini, Professor of Surgery at Naples, published his General Anatomy of all Animals, but there is very little about the horse. In 1660 R. Barret, a veterinary

* In 1614 he published a book, " The English Husbandman," in which is said he had discovered twelve medicines, " such as no man had previously found out," which perfectly cured all the diseases to which horses were liable, and that the scheme was " worthy to be preserved to all posterity for ever and ever." In his " Masterpiece " he asks the reader to give " God the glory and Markham thanks and good wishes " for his discoveries and advice !

† The authority is J. Girard, Traité d'Anatomie Vétérinaire, 1819. I have not seen the work.

practitioner in this country, published a work on the diseases of horses, in which he undertook to give an account of the "true anatomy and inside of a horse, with his entrailes, sinews, and number of bones and veynes." As a matter of fact, he gives no account whatever, but presents his readers with an anatomical plate (see Fig. 7). On one point he is definite, he affirms the existence of a brain in the horse.

In 1666 Willis described the brain of ruminants and other animals, and the spinal cord of the horse. In 1667 Lower described the Corpora nigra of the eye of the horse, which he mistook for a pathological condition. Needham, in 1667, published his account of the fœtal envelopes, including those of the mare and cow. In 1677 Glisson

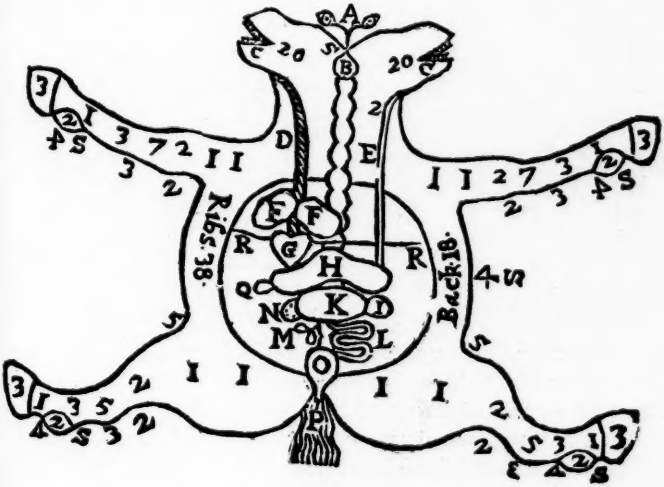


FIG. 7.—A DISSECTION OF THE HORSE.
The numbers indicate the number of bones in the part.
R. Barrett, 1660.

published a tract on The Comparative Anatomy of the Stomach and Intestines, in which he described the horse as possessing a double cæcum. N. Grew in 1681 published a work on the same subject and corrected Glisson's error respecting the cæcum. Grew described the external appearance of the stomach of the horse, but did not examine the interior, giving the remarkable reason that he had not time! He thereby missed a most interesting piece of anatomy. Between 1673 and 1681 G. Blazius published his various works dealing with the anatomy of animals; they are excellent, and the plates, with one exception, admirable. The skeleton of the horse is bad, and shows

this animal as possessing clavicles. Blazius dealt more especially with the dog and sheep. He drew upon and acknowledged the works of Fabricius and Casserius.

In 1683, Andrew Snape, Veterinarian to the Court of Charles II, published his Anatomy of the Horse. Snape appears to have fortified himself for this undertaking by a course of human anatomy. His work is very incomplete. The muscular system is imperfect. He describes clavicles to the horse, and states that they support the shoulders; he is very poor on the anatomy of the foot. The fact is Snape followed Ruini and boldly appropriated twenty-two of his plates without acknowledgment. He has indelibly stained his reputation by this act, and by the statement he makes that no one had preceded him in the study of the anatomy of the horse.

In 1685, S. Collins, Physician to Charles II, published his System of Anatomy. It is comparative, and extends from man to insects. There is very little in it about the horse, probably for the reason that his colleague Snape had the matter in hand; ruminants receive attention, while the anatomy of the cat and dog obtains full notice.

In 1685 J. Conrad Peyer published at Basle a large work on Rumination, in which the most exact and beautiful anatomical plates of the ruminating organs will be found. He described all the compartments with infinite care, and with the exception of the nerve supply left little else for future observers to discover.

In 1707 Dr. J. Douglas produced a "Comparative Anatomy of Muscles," in which those of man and the dog are compared. It is an admirable work, and from it we learn the course of instruction given in London two hundred years ago on the subject of comparative anatomy. In 1721 John Gibson, a surgeon, who practised veterinary medicine, published a treatise on diseases which also professed to embody the anatomy of the horse; all he did was to copy Snape and to repeat his errors. It became fashionable during this century for English veterinary writers to prefix their work on diseases by an anatomical exposition, which was generally a variant of that provided by Gibson. It was, however, a sign of the times and indicated a desire for advancement; nearly all these writers were self-taught, for no veterinary school as yet existed in this country.

"An Essay on Comparative Anatomy" was published anonymously in London in 1744. It is an extremely interesting work, designed to elucidate the function of parts in man by an examination of the corresponding structures in the lower animals. The anatomy of the dog was dealt with in considerable detail. The supposed author of this book was a medical man at whose death the MS. was found and

was printed by his executors on account of its value. It subsequently transpired that the MS. represented notes taken at the lectures on Comparative Anatomy delivered by A. Munro (primus), Professor of Anatomy at Edinburgh.

In 1751 Claude Bourgelat, of Lyons, one of the two leaders of the eighteenth century in the veterinary world, published his Anatomy of the Horse, the best which had yet appeared. It was incomplete, and in 1769 a new work on the subject was produced, which was a monument to his skill and untiring industry.

In 1751 there was published in this country the first work on the Anatomy of the Foot of the Horse by J. Bridges. He gave an account of his dissections, with original plates. The work is incomplete, but greatly superior to its predecessors in this country, *i.e.*, the chapter on the Foot by Snape. Buffon's Natural History appeared in English in 1762. Vol. IV deals with the domesticated animals and portions of their anatomy. There is a full account of the stomach of ruminants, beautifully illustrated, and the generative organs of bovines. It is singular with what persistence these structures were described by various observers.

The next anatomy of the horse to appear in England was by a celebrated animal painter, George Stubbs, in 1766. The figures are all drawn to scale and the plates are as much as eighteen inches in length. Stubbs made his own dissections, but the work, though superbly reproduced, was only of use to art students. It deals mainly with the muscular system and skeleton ; vessels and nerves are only referred to in connection with their relationship to muscles, while the cavities of the chest and abdomen are unnoticed.

In 1772 La Fosse Junior, the second of the great French anatomists in the eighteenth century, published his immense anatomy of the horse. The plates are coloured, and nothing on such a large scale has since been attempted. The production of this work ruined the author financially, but as an anatomy it was superb, and, together with the work on the same subject by Bourgelat, placed veterinary anatomy at a very high level.

A. Munro (primus), whose treatise on Comparative Anatomy was innocently published in 1744, as narrated above, dealt mainly with the dog. His son, A. Munro (secundus), a distinguished comparative anatomist, published the original in 1781 in the collected edition of his father's papers. The second Munro also published a thesis on the testicles and vesiculae seminales of animals in 1755.

B. Harwood, Professor of Anatomy at Cambridge, published in 1796, Vol. I of his System of Comparative Anatomy, illustrated by

beautiful plates. This volume deals mainly with the olfactory organs, and those of domesticated animals receive considerable notice. The work never appears to have got beyond the first volume.

Strickland Freeman, a wealthy man who was connected with a riding school, was the next in this country to attempt to elucidate the Anatomy of the Foot of the Horse in 1796. Meeting with an accident, he was attended by John Hunter and E. Home, who would appear to have encouraged him to write a treatise on the Foot. Freeman knew nothing of anatomy, and had never dissected. Home provided him with a trained assistant, who made the injections, and did the dissections. These were engraved and hand-coloured by the best artistic talent of the day, the result being a very beautiful series of anatomical plates, to which the text is unequal. Freeman naturally could not describe all he saw owing to the absence of anatomical training, and though Home corrected the text, the result is not very satisfying. No names are assigned to any of the structures.

In the same year, 1796, D. Blaine, a surgeon who had turned to veterinary practice and was now teacher of Anatomy at the newly-founded Veterinary School in London, produced an Anatomy of the Horse, which was issued in parts. It was projected on an expensive scale as regards plates, and after the sixth had been prepared, no more could be issued. The letterpress, however, was continued and is of unusual merit. There are many errors which ought not to have occurred; he denied, for instance, the presence of maxillary sinuses in the horse, and described two curvatures in the urethra of this animal which prevented the passage of a catheter; in subsequent issues of his work the errors were eliminated.

We have now noted all the veterinary anatomical treatises occurring in English in a period of three hundred years, and practically all those issued on the continent of Europe during the same time, and one cannot fail to be disappointed. Apart from the work of the skilled human anatomists from Fabricius to Harwood, whose interests were comparative rather than veterinary, only five trained observers are to be found throughout that long period—Bourgelat and La Fosse, junior, in France, Ruini in Italy, Snape and Blaine in this country. It was not until the middle of the eighteenth century that any attention was paid to the question of the development of veterinary education, and it was only as the century was closing that this took concrete shape in the form of a school in London. This, it may be added, was founded by laymen, who were strongly supported by John Hunter and the principal medical and surgical teachers in the metropolis. It is noteworthy that one of the earliest works to be published by this new school was on The Anatomy of the Horse.

SPONTANEOUS ENCEPHALO-MYELITIS OF RABBITS, AND ITS RELATION TO SPONTANEOUS NEPHRITIS, ETC.

By C. C. TWORT, M.D., and H. E. ARCHER, L.R.C.P., M.R.C.S.,
Pathological Department, St. Bartholomew's Hospital, E.C.

In a recent communication to this Journal (1) one of us gave a short description of a disease which broke out spontaneously among a number of experimental rabbits, and which it was thought had not hitherto been described. It appears, however, that histological changes in the central nervous system of rabbits, similar to those found in the above-mentioned animals, had been demonstrated previously by Oliver (2); and this author mentions a still earlier observation of Bull (3).

It is a curious fact that, while the disease in our stock led to death in practically every case in which symptoms occurred (mortality over 90 per cent.), the animals of both Oliver and Bull were mostly in good health until a fatal experimental dose of arsphenamin or streptococci was given; and subsequent examination of the central nervous system revealed the unforeseen lymphocytic invasion of an encephalitis. It is rather difficult to gather from Oliver's paper exactly how her animals reacted to the disease clinically; she mentions in one place that they "rarely die," but it appears that, generally speaking, health was normal. She found a similar condition in 20 per cent. of rabbits obtained from the public markets, and we have since demonstrated the changes in several animals which were killed when having the appearance of being in perfect health. Up to the present, however, we have been unable to find any trace of the disease among the laboratory stock of the Brown Institution, London; and in our stock the small epidemic which prevailed seems to have subsided.

We note, then, first of all, that rabbits may suffer from an encephalomyelitis, although apparently in good health, but that under certain circumstances the disease may become virulent and lead to a rapidly fatal termination.

There is a second point, however, which is of considerable interest. A condition known as spontaneous nephritis of rabbits has long been recognised, and numerous workers have come across the disease while studying the experimental production of nephritis in this variety of animal. From the examinations made by Bell and Hurtzwell (4), and by the several authors they mention, it appears that among 400 animals the kidneys of about 15 per cent. showed evidence of renal disease. As far as our own post-mortem examinations of nearly an equivalent number of animals are concerned, we have not previously encountered this spontaneous nephritis nor the spontaneous encephalomyelitis.

According to Bell and Hurtzwell, " . . . we are not dealing . . . with a diffuse interstitial nephritis such as occurs in diphtheria and scarlet-fever, but with discrete lymphocytic foci which cause atrophy of the entire tubule system by destroying its central portions." In our animals which succumbed to an encephalo-myelitis a pronounced nephritis has frequently been found, with or without hepatitis and splenitis. It would appear that possibly one and the same virus is the cause of the pathological changes in the central nervous system and the abdominal organs, and it is interesting to note that, while the lesions in the central nervous system may be slight, those in the kidneys may be extensive, and *vice versa*. In support of this view is the fact that Condrea (5) has reported the production of an experimental nephritis in rabbits as a result of the intro-cerebral injection of vaccinia virus, and we are under the impression that nephritis has also been produced in rabbits experimentally inoculated with encephalitis-lethargica material. Unfortunately, in the publications on spontaneous nephritis we can find no evidence that examinations of the central nervous system were made in conjunction with those of the kidney; and Oliver does not mention specifically whether the kidneys were examined in her cases of spontaneous encephalo-myelitis.

The contention of Bell and Hurtzwell that the virulent staphylococcus which was isolated on two occasions from their cases of spontaneous nephritis was probably the causal agent of the disease is, in our opinion, not justified, although the said staphylococci were isolated in pure culture. That the staphylococcus they isolated was a micro-organism living in symbiosis with a specific filter-passing virus would appear to be much more probable, so many examples of such a symbiosis being known to occur in diseases of man and animals. It is to be understood that the word symbiosis is not used here in its strict sense, a mutual benefit being usually implied. The fact of there being a lymphocytic invasion and not a polynuclear one should make one hesitate to assign an ordinary bacterium as causal agent of the disease, although, of course, some special bacteria such as members of the acid-fast group and a few other related forms do excite the migration of lymphocytes. As regards what is called by some authors " glandular fever," in which it is said that a mononuclear leucocytosis occurs (Bloedorn and Houghton (6), Gordon (7), Sprunt and Evans (8), Tidy and Morley (9), etc.), it is possible that here again a filter-passing virus is present in conjunction with an ordinary vegetable parasite. The question of its relation to leucæmias and anæmias cannot now be discussed. We are disinclined to agree with those authors who assumed that streptococci which were present in certain situations in their cases were responsible for the peculiar blood pictures obtained, and we

cannot see that the observations they made justified the conclusions drawn from them. An invasion by lymphocytes under the sole stimulus of an ordinary bacterium would appear to occur with a frequency about equal to that of a polynuclear invasion excited by a filter-passing virus ; that is to say, at the most it is very exceptional, and probably really does not occur at all.

Whether death of our animals has been due to the nervous or the renal lesions it is impossible to say ; probably sometimes the one and sometimes the other. As a matter of fact, we have found that the blood urea of the animals suffering from nephritis may be very high, quite high enough to cause a uræmic death if one can argue from an analogy with human cases. The normal urea content of the blood of rabbits appears to be about the same as that of man, *viz.*, 0.040 per cent. : in one of our animals the figure obtained was 0.260 per cent. There are also certain variations in the lipase content of the blood which we are at present investigating, and it is probable that interesting changes will also be found in the blood of patients suffering from or convalescent from other filter-passing diseases. As one of the characteristics of these diseases is a lymphocytic invasion, one would expect to find alterations in the lipase content of the blood. As regards the urine, the urea concentration has been found to be low, and albumen may be present ; we have not, however, performed a sufficient number of these biochemical tests to be able to draw conclusions of any real value.

In reviewing the subject and taking into account diseases of a similar nature, one was not surprised to find, in animals suffering from encephalo-myelitis, lesions outside the central nervous system. It may be of interest to consider for a moment one or two of these comparative diseases. Distemper of dogs is an excellent example of a disease showing diffuse lesions. Here the central nervous system, lungs, intestines, etc., may be infiltrated at one and the same time, or the disease may be localised to one particular organ ; and there are other features in distemper of dogs which seem to resemble those found in encephalo-myelitis of rabbits.

In association with researches on filter-passing viruses carried out at the Brown Institution, London, during 1912-14, by F. W. Twort and one of us (10), were a number of experiments on distemper of dogs. Acute and chronic cases were utilised for the supply of inoculation material, and they included nervous, thoracic and abdominal forms of the disease. It was found that the difficulty of transmitting the disease experimentally was great, although young puppies were used, and all the classical methods of inoculation were resorted to. Cage infection experiments were, however, not infrequently positive.

We have seen that encephalo-myelitis of rabbits is highly infectious (1), at least among young animals housed in a fairly confined space, while, at the same time, the transmission of the disease experimentally by the inoculation of presumably infective material has proved to be a matter of considerable difficulty. On the other hand, among the animals utilised by workers on hydrophobia, infantile paralysis and encephalitis-lethargica, we believe it is rare for cage infections to occur, although all three of these diseases are, relatively speaking, easy to transmit by ordinary inoculation methods. Often it is sufficient to instil a few drops of an emulsion obtained from a case of encephalitis-lethargica of man into the eye of a rabbit in order to produce a keratitis with a fatal terminal encephalitis. In infantile paralysis and encephalitis-lethargica we know that, as regards the homologous animal, infection is of the " cage " variety, but the question as to whether the experimental inoculation from man to man of the virus of these human diseases would lead to infection cannot, of course, be answered.

That an unfiltered emulsion of fresh nervous tissue from a fatal case of encephalo-myelitis is frequently without the slightest effect on inoculated animals, no matter by what channel the emulsion be given, is puzzling in the extreme, especially in view of the cage infections. A natural immunity would not explain the matter, on account of the cage infections, and the animals that were utilised were too young to have acquired an immunity. The same may be said to apply to our distemper experiments. There is, however, the possibility that the injection given may immunise to some extent instead of leading to a true infection. Also there is presumably a far greater quantity of the virus in the inoculum than would be received by the natural means of cage infection, and in the latter case the animal is undoubtedly exposed to repeated infection, being, as it were, sensitised by the primary infection. There are many other possible explanations which belong to the subject of infection and immunity in general, and it will be unnecessary to speculate further on the subject in this note.

To summarise, it may be said that, among this group of diseases the specific disease for a certain variety of animal is often more easily transmitted by cage infection to a homologous animal than to certain heterologous ones ; while, when experimental inoculation is resorted to, the results may be reversed. Thus :—

	Homologous Animal.		Heterologous Animal.	
	Cage.	Inoculation.	Cage.	Inoculation.
Encephalo-myelitis ...	easy	difficult	?	?
Distemper	,,	,,	?	?
Encephalitis-lethargica ...	,,	?	difficult	easy
Infantile paralysis ...	,,	?	,,	,,

Hydrophobia, a disease belonging to the same group, is, however, different in the sense that it affects a greater variety of animals,

and the natural mode of infection is by biting; it is, therefore, not considered in this discussion.

One might almost hazard the suggestion that under certain circumstances a third factor may come into play besides the virulence of the virus and the resistance of the host, *viz.*, an insect carrier; and we know that such a carrier is of prime importance in yellow fever, typhus, etc., although these filter-passing diseases are presumably caused by quite a different catagory of virus to that causing the diseases now under consideration.

Conclusions.

(1) A good proportion, 10—20 per cent., among certain stocks of rabbits suffer from a spontaneous encephalo-myelitis.

(2) The same may be said as regards the advent of a spontaneous nephritis.

(3) It is possible that these two conditions are occasioned by a single virus, almost certainly a filter-passer.

(4) The disease, while usually benign, may become suddenly virulent, and lead to a high mortality.

(5) As with distemper of dogs, the disease is often more easily transmitted by cage infection than by artificial inoculation.

(6) Death would, in some cases, appear to be due rather to the renal than to the nervous lesions.

(7) In fatal cases the blood urea may be high, and the urea concentration of the urine low. There may be, also, albuminuria.

(8) There may be marked variations in the lipase content of the blood.

Finally, it may be emphasised that, as the rabbit is an animal which is extensively used in laboratories for experimental purposes, especially for work on filter-passing viruses and the testing of drug toxicity, it is manifestly of the first importance that workers should bear in mind the possibility of their animals being infected with a spontaneous filter-passing disease, and that they should be familiar with the histological appearances of the organs in the disease. This is all the more so in view of the fact that the majority of the animals seem to be quite healthy, and it is usually impossible to detect any trouble during life. Indeed, it may be that the urea content of the blood or urine, and the presence of albumen in the latter, might serve to indicate exclusion from experimental work of certain isolated animals, as might also the presence of a mononucleosis in the cerebro-spinal fluid exclude others, but we imagine that all workers would not

feel inclined to undertake such preliminary examinations, which, at the best, must be of very doubtful value.

REFERENCES.

(1) THE VETERINARY JOURNAL, 1922, June, p. 194.
(2) *Jour. Infect. Diseases*, 1922, Vol. 30, p. 91.
(3) *Jour. Exper. Med.*, 1917, Vol. 25, p. 557.
(4) *Jour. Infect. Diseases*, 1919, June, p. 628.
(5) *Comp. Rend. Soc. de Biol.*, 1922, Vol. 86, p. 15.
(6) *Arch. Int. Med.*, 1921, March 27, p. 315.
(7) *Lancet*, 1921, July 30, p. 230.
(8) *John Hopkins' Hosp. Bull.*, 1920, November, p. 410.
(9) *B. M. J.*, 1921, March 26, p. 452.
(10) (C. C. T.) Unpublished researches.

EXPERIMENTAL STUDIES ON FOOT AND MOUTH DISEASE MADE AT THE ROYAL FARM OF POGGIO A CAIANO, NEAR FLORENCE.

BY DR. G. COSCO,
General Veterinary Inspector;
AND
DR. A. AGUZZI,
Provincial Veterinary Inspector in Florence.

ON behalf of the General Direction of Public Health we made at the Royal Farm of Poggio a Caiano—from June, 1915, to October, 1919—a long series of experiments on the prophylaxis of foot and mouth disease, endeavouring to find a practical method of vaccination against the aforesaid disease, as a sequel to our studies on the virulence of the blood of animals affected by foot-and mouth disease, of which studies we have already published previous notes.*

At the meeting of the Committee of February 8, 1921, appointed by the Home Minister to control the experimental studies on aphta, by the same Minister entrusted to some experts in different parts of Italy, we have published in a detailed report† the result of our somewhat long work, receiving from the Committee approbation and encouragement to continue the promising researches.

Our report is divided into two parts: the first treats of the fundamental fact concerning the virulence of the blood of animals affected by aphta, and of the method of vaccination derived from the knowledge of the aforesaid virulence; the second part treats of the microscopical researches, made especially on the blood of oxen affected by aphta, and of other experiments on localisation of the virus in certain organs.

---

* G. COSCO E A. AGUZZI.—La virulenza del sangue degli animali malati di afta epizootica. *La Clinica Veterinaria*, No. 7, Milano, 15 aprile, 1916.
G. COSCO E A. AGUZZI.—"Sulla virulenza del sangue dei bovini aftosi e prove d'immunizzazione contro l'afta epizootica." *Tipografia Artero*, Roma, 1917.

† Published in *La Clinica Veterinaria*, Milano, Anno 1922.

FIRST PART.

It begins with a chapter concerning the type of the fever that accompanies the infective aphtous process, which is the starting point of our whole work.

Experimenting on several hundred oxen—affected naturally or by artificial contagion—we have found that in the beginning the infective aphtous process is always accompanied by fever of a remittent type, with daily attacks, presenting a thermal curve of a certain regularity which is quite characteristic.

During the attack different phases may be distinguished. It begins with a slight thermal increase—which lasts from two to six hours; then follows a sudden increase of temperature till it reaches the acme, which lasts a few hours; this is followed by a remittent state, which sometimes falls almost to normal temperature after some hours; and at last there is a pause, which is followed by another attack similar to the first. The attacks return one after the other, and their acme generally falls gradually.

The interval between the attacks, as well as the greatest height and number of same during the whole infective process, vary according to the form and gravity of the aphtous infection.

Some chapters follow in our report, which indicate :—

(1) That the incubation of aphta varies according as to whether the disease is caused either by natural or artificial contagion. (In this regard it is interesting to note that the incubation is of much greater length after inoculations of virus contained in the blood, and especially in the red corpuscles.)

(2) That the exanthematous eruptions coincide exactly with the oncoming of every feverish attack. However, they rarely develop in the first attack; on the contrary, in the disease obtained through the injection of virus contained in the blood they appear much later than when the infection is either natural or caused by direct artificial contagion.

(3) That the clinical phenomena relating to the aphtous septicæmia and to the degenerative changes of the myocardium, even in cases of malignant aphta, are not always in proportion to the gravity and extent of the external aphtous eruptions.

The following chapters treat amply of the virulence of the blood; which, denied by some, and admitted by others, "as very weak and difficult to put into evidence," has been shown by us to be absolute and constant.

The data minutely gathered from the experiments made on as many as 170 oxen are shown in two tables, from which the following results are drawn :—

(1) That the virulence of the blood is connected with the serum and

red corpuscles in a very different way, especially as for the various phases of the thermal curve, which characterises the feverish aphtous process.

(2) That the serum has a minimal virulence in the early thermal phase of the fever ; it becomes maximal in the acme, gradually diminishing during the remittence, until it decreases to a minimal degree in the later stage. So that the serum is always virulent during the whole duration of the infective aphtous process, reaching the greatest activity in every feverish acme.

(3) That the red corpuscles are virulent only during a certain extent of the thermal curve, *i.e.*, from the so-called early thermal phase to the feverish acme. Their virulence is minimal at the beginning of the early thermal phase, becomes maximal at the end of it and at the beginning of the sudden thermal increase following the aforesaid phase, and again decreases directly to disappear towards the middle of the acme. They are, therefore, never virulent in the successive feverish phases.

(4) That, after having separately inoculated subcutaneously red corpuscles and serum of maximum virulence, the latter is much more active than the former, original dosage being equal.

The results obtained from another long series of experiments have led us to the following statements :—

(1) The red corpuscles do not lose their virulence, not even after every trace of serum has been removed from them by repeated washing.

(2) The serum of blood kept in the refrigerator, at an average temperature of 8° C., loses some of its virulence after three to five days ; after 21 days it is no longer capable of reproducing the disease when inoculated subcutaneously ; whilst the red corpuscles lose their virulence more slowly, but retain it in a slight degree, for at least a month.

(3) Blood serum, as well as virulent red corpuscles, administered to oxen by the mouth are not able to develop the disease.

(4) The infection due to subcutaneous injection of serum or virulent red corpuscles is always of less gravity, both in the number of feverish attacks, or in its issue, in comparison with the natural disease of the subject which supplied the serum or red corpuscles.

Furthermore, contrary to our first observation as reported in our second note of 1917, we have been able to establish, by means of other long researches, that subcutaneous injections of blood virus—serum or red corpuscles—not only never reproduce the most serious forms of epizootic aphta, but, by serial inoculation in oxen, they rather tend to lessen than to increase the virulence.

A special chapter follows concerning the particular action of blood-virus inoculated in the veins.

The introduction in this way of globular virus does not reproduce the disease, not even in the quantity of 25 c.c.—that is, as much as $2\frac{1}{2}$ the optimum dose which is capable of determining it through the subcutaneous inoculation; whilst somewhat smaller quantities of virulent serum inoculated in the veins are sufficient to reproduce it, with a shorter incubation.

As the immediate result of venous inoculation with red corpuscles of maximal virulence, a thermal and organic reaction is observed after a few hours; this lasts for some hours, and usually reappears on the second day, and sometimes on the third and further on, diminishing by degrees in intensity.

A further effect to be seen later on is a state of greater resistance in the inoculated animal, which happens after a period of 15 days at least, during which the ox shows itself more liable to contract the infection (negative phase).

Considering these properties of the red corpuscles, the idea of a method of anti-aphtous vaccination occurred to us.

The experiments concerning the deportment of the globular virus through the endo-venous way, and the determination of a practical method of vaccination, were made on a great number of animals—more than a hundred—and, although it has not been possible for us to finish them, for several reasons beyond our control, and above all on account of the necessity of leaving the station of Poggio a Caiano, still they have led us to the following conclusions:—

(1) Although the globular virus, attenuated or killed, inoculated in the veins produces a certain degree of greater resistance in the animals, it is not sufficient, however, to confer upon them any immunity that might be utilised.

(2) A single injection of virulent red corpuscles into the veins confers on oxen a state of greater resistance to natural contagion.

(3) Three, or even two, injections of active globular virus into the veins are able to produce in oxen a state of immunity for at least three months.

(4) In order to apply the multiple endo-venous method, which certainly is necessary to obtain a more solid and durable resistance, it is necessary to practise the successive injections at intervals of no less than a fortnight.

Second Part.*

After some attempts at microscopical researches on the blood of aphtous oxen, we have made a rather far-reaching and very long study of it in the field.

* This second part, concerning the microscopical researches and experiments on the part taken by some organs in the aphtous process, is Dr. Aguzzi's personal work.

We have thus been able to put into evidence some special corpuscular elements, which are seen with the paraboloid, in the blood plasma, and particularly in characteristic forms in the interior of red corpuscles of aphtous oxen. We have shown in the same way the presence of nuclear remnants or nucleoid bodies in the red corpuscles of oxen, which are constantly discovered not only in sound oxen, but also in some of their pathological conditions.

And as their presence makes the identification of the aforesaid endoglobular corpuscular elements of aphta rather difficult, and was the cause of a very serious hindrance for our researches at the very beginning, we deemed it necessary for a clearer understanding to speak fully of it in a first chapter.

Having firstly described minutely the technic used for the researches with the paraboloid, we proceed to treat of the nuclear remnants as well in healthy as in oxen suffering under some pathological conditions.

In healthy oxen they appear under irregular forms of rather large dimensions, and more generally as round corpuscles, comparatively small, isolated, or coupled together in one red corpuscle ; sometimes they are very minute and numerous in the same corpuscle.

In all these forms they are not " central and mobile," as they have been described by histologists on examination with the paraboloid.

Their mobility shows itself in every direction ; it is rather rapid in the fresh test and diminishes with the drying up, till it ceases altogether.

During the rotatory movement the cellular corpuscle, when attentively observed, shows a morphological characteristic, which otherwise would elude observation, namely, that it is not a spherical or globular corpuscle, but flat. Therefore, when seen in a horizontal position it appears, for instance, with an irregular outline, with its body stretched in one direction or swelled ; while in vertical position it no longer shows any outline, but, of course, appears as a simple line.

The nucleoid bodies tend to modify in their form by ceasing their movement and becoming smaller and round.

At last, with the destruction of the red corpuscle the nucleoid body, which is contained in it, is also destroyed.

Under different abnormal or pathological conditions of oxen it has been established that red corpuscles provided with nucleoid bodies can be found in much greater number than usual, and that nucleoid bodies in very different and voluminous forms predominate.

The blood extracted from aphtous oxen during the so-called early thermal phase of the feverish attack, examined with the paraboloid, shows in the interior of the red corpuscles some characteristic corpuscular elements which are visible only for a few hours (four to five

hours). These corpuscles are not visible if the blood has been drawn during the attack or during the feverish remittances and pauses.

They have an oval, pear-shaped, elliptical, lengthened, knotty, multiple granular, form in the various moments of the aforesaid phase.

Their mobility is active and characteristic ; they change their places in every direction, doubling themselves up, with evident active contraction of their body and showing a vermiform movement.

The number of the red corpuscles which, in a test, may be found provided with these corpuscular elements is always comparatively small.

They differ, therefore, from the nucleoid bodies for their characteristic vermiform movement, for their globular shape with an outline always clear, in whatever position they may be found.

Moreover, the differentiation is brought about by other very important facts ; in effect, whilst the nucleoid bodies with the drying up of the test, and consequently with the swelling of the red corpuscles, change their shape and tend to become immobile, the elements of aphta never change their form, but keep their characteristic mobility. Furthermore, the nucleoid body undergoes destruction at the same time as the red corpuscle which contains it, whilst the element of aphta frees itself, keeping its shape and its mobility.

Granular and very mobile elements are to be seen in variable number, from the very beginning of the feverish attack, in the blood-plasma as well as in the lymph of the aphtous vesicles.

From all these facts, and by the above-mentioned observations, one might come to the conclusion that the hypothesis according to which the aforesaid endoglobular corpuscular elements may represent persisting nucleal remnants, as a consequence of abnormal erythroblastical proliferation perhaps originated by the aphtous virus, finds its confirmation in the following facts :—The comparatively not easy differentiation of the corpuscular elements seen in the blood of aphtous animals from the nuclear remnants, which especially appear in certain pathological conditions ; the small number of red corpuscles provided with the aforesaid corpuscular elements during the aphtous process ; the impossibility to exclude—in the present state of our observations—the fact that in no other pathological state of cattle such endoglobular elements are to be observed ; and, lately, the fact which will be spoken of later on, namely, that the other body organs take a part in the aphtous infective process. But the constant presence in all oxen affected by aphta and the correspondence of the virulent phase of the red corpuscles as previously shown with the appearance of the special corpuscular elements, lead us to believe that the latter are really specific elements of the infection.

The methods of colouring the blood of aphtous oxen gave no very satisfactory results ; they only showed some endoglobular and extra-globular forms, that have some special character of structure and colouring ; but which at all events are not, at least for the present, well distinguishable from other elements of the blood.

Finally, some researches and experiments on the part taken in the aphtous infective process by the lymphatic ganglionary system and the other body organs have been reported.

To this purpose we refer the data obtained by two preliminary experiments, which, although unique and therefore not decisive, may at least furnish a certain indication.

As a conclusion it has been established :—

(1) That the pulp of certain lymphatical ganglia, inoculated subcutaneously, is virulent ; thus an attenuated clinical form of the disease with quite particular characteristics would be reproduced in oxen.

(2) That the pulp of the spleen, inoculated subcutaneously, is also virulent, and causes in oxen a form apparently more serious than that which is reproduced with the blood-virus.

As a general conclusion of our work, it has been established that the experiments, in which 660 oxen were employed, have made known some facts which so far had not been observed by others, and led to some important knowledge on aphtous infection as well from the practical as from the scientific point of view.

Clinical Articles.

INDUCED PTYALISM: A MULE'S HABIT.

By Major J. R. HODGKINS, D.S.O., F.R.C.V.S., R.A.V.C.
Secunderabad, India.

A MULE admitted to hospital for some simple ailment was noticed to have always a pool of " water " on the ground in front of him.

This attracted attention to a peculiar habit. The mule could be seen to stretch its neck and head, and set its lower lip firmly against the inferior incisor arcade. It then commenced to slap the upper lip at a great rate vigorously over the tightly-stretched bottom lip. This procedure induces a great flow of saliva, and when sufficient has collected, the mule opens its mouth and permits the liquid to drop out. The cycle recommences.

The animal apparently occupies all its spare moments—which are many—in hospital at this pastime. The upper lip has developed very much. It is long and muscular.

The Veterinary Assistant in the hospital says he saw a similar case

also in a mule whilst he was in Mesopotamia. A bucketful of saliva could be collected at one *séance* from this Mespot. mule. This is easily to be believed after seeing the evidence of this case as an example of the amount that can be produced in this manner.

OVARIOTOMY IN THE MARE BY THE FLANK METHOD.

By FRANK CHAMBERS, O.B.E., F.R.C.V.S.,
Wolverhampton.

THE subject was an aged hunter, who was a splendid worker until she came into œstrum, when she was unapproachable. She had apparently frightened her owner so much that he sold her to me for a few pounds in order to get rid of her. I suggested performing ovariotomy, but he would not go to any expense. On August 3, after due preparation, I injected morphia grs. 8 subcutaneously. An hour afterwards she was hobbled without any difficulty, cast, and chloroformed. An area over the left flank was clipped, shaved and painted with iodine. An incision about seven inches long was made through the skin, and the muscle superficially cut. An opening was made into the abdominal cavity by separating the muscle fibres and bursting the peritoneum with the fingers. Both ovaries were easily found, and removed with the ecraseur. The left ovary was cystic and measured five inches in diameter. I had a little difficulty in getting it out through the small wound in the muscles.

Two catgut sutures were placed through peritoneum and muscle, and six silk sutures in the skin wound. The wound was dusted with iodoform, and a ring of hot glue painted round the incision on the skin some three inches away from it. A gauze pad was applied, which adhered firmly around the outside to the glue.

There was a certain amount of swelling next day, and on the fifth day I removed the gauze and the two lowest sutures. About four ounces of clear serum escaped. The wound was syringed out daily with Ensol. On the twelfth day one of the catgut sutures came away, the knot apparently having come untied. The wound healed up without further trouble in twenty-one days, and her temperature did not go above 101. The mare has become quiet and never offers to kick, but she has not forgotten how to use her teeth. From a practical point of view, the flank method cannot compare with the vaginal, because the wound in the former takes much longer to heal, and it has been proved that the sooner a kicking mare is put to work after having been spayed, the better. I had never previously operated on a mare through the flank, and my only object in doing so was in order that I might compare these two methods.

NOTES ON THREE CASES OF PARAPHYMOSIS.

By A. M. WHITEHOUSE, M.A., M.R.C.V.S., V.S. (Toronto),
Professor of Anatomy and Acting Principal, The Veterinary College, Glasgow.

Case I.—About 1899. A roan registered shire stallion (young) had been running out with mares in pasture in Wyoming. When brought up at the end of the season he showed the condition as I saw it later. This horse had naturally a very large penis, and presented, at the point where the integument of the penis leaves off and the reflected part of the prepuce begins, an enormous collar-like enlargement, dense to the touch. At that time I knew nothing for paraphymosis except treatment, including support, pressure and iodine, or amputation. The retractor penis was strong, and I was able to return the mass into the loose large sheath and keep it there with a suspensory bandage. Two or three months of treatment brought no reduction of the enlargement, and I amputated and castrated. I then found that the collar mass was composed of very dense fibrous tissue, but that it was not closely attached to the underlying tissue and could have been easily removed. The new tissue only embraced about the upper two-thirds or three-quarters of the circumference.

Case II.—In 1905. A French-bred Percheron stallion of considerable value, about 8 years old. He had the same history—had been running with mares in a Wyoming pasture, and had been brought up with the condition well established. In this case the penis was not quite so large, and the collar not so big, but in exactly the same place. The mass was quite loose, and I put sutures beneath it before removing, but did not interfere with the urethral face of the organ. The retractor penis was strong enough. I removed the mass and put in a few more sutures. Considerable swelling followed and some suppuration. I removed the sutures by degrees and got a very satisfactory recovery, the horse being able to serve mares in about seven weeks. Perfect power of retraction was regained. I had, of course, no idea of Vennerholin's operation, and was trying to save all the integument possible so as not to shorten his stroke.

Case III.—In 1910. A common-bred draft stallion of great strength and vitality. In this case the retractor penis was very weak, the organ swinging at almost full length. The enlargement was not very great, but closely adherent to the tunica albuginea of the penis, especially on the superior aspect. The history was like that of the others, and the enlargement at the classical point. Power of erection was well maintained, but the enlargement acted as a washer, and the horse was stopped at this point in his "cover." In operating the dissection was tedious, and required the cutting edge at nearly every point, suturing the skin over the seat of dissection not being possible.

Healing left a rough surface of sear tissue, but copulation was successfully performed afterwards. Retraction was fair as long as a suspensory was used, and would, I think, have been perfectly regained if the owner had persevered. As it was, paraphymosis became complete again, though there was no recurrence of the enlargement, and I castrated and amputated next season.

I should think, then, that a conservative Vennerholin, such as I did unknowingly in Case II, would correct the condition without interfering with usefulness in a good percentage of the cases tried; but where the enlargement is adherent to the albuginea I should not be very hopeful.

OBSTRUCTION OF THE INTESTINE BY A CONCRETION; TAPÆOTOMY FOR REMOVAL; FAILURE.

By R. HUDSON, F.R.C.V.S.,
Retford.

THE subject was a 15-hand cob, lately drafted out of the Army, and a succession of similar cases had made me confident in my diagnosis even though I failed to find the obstruction per rectum. For a fortnight the horse had been showing intermittent colic, passing nothing per rectum after the first day but a small quantity of mucoid material. As it was evident that the animal was going to die, although it was very bright at times, it was decided to attempt an operation.

After preparation in the usual way, a flank incision was made through the skin, muscles and peritoneum sufficiently large to admit my hand and arm freely. On passing in my hand I found the surface of the intestines very dry, and, the intestines being distended with gas, I could not pass my hand at all freely. Dipping my hand into carbolised oil (1—20), I to some extent overcame this difficulty, but the distension of the intestines hindered a minute search. Nevertheless I examined the abdominal cavity from the liver to the rectum, and the intestines from top to the underside of the abdominal cavity. I examined until I was tired, and, as I found nothing, I decided to close the wound, suturing the peritoneum and abdominal muscles and skin separately with interrupted silkworm gut sutures. The patient was allowed up as soon as she was out of the anæsthetic.

Except for a small abscess which formed beneath the skin, the mare was no worse for the operation, and lived for fourteen days, dying at the end of this time from rupture of the large colon.

On post-mortem examination a large concretion was found obstructing the beginning of the small colon. The case is interesting in that it shows that one may freely search the abdominal cavity without ill effect, and it also demonstrates some of the difficulties one meets with in bowel cases.

GRAVES' DISEASE IN CATTLE.

(A Preliminary Note.)

By L. P. PUGH, B.Sc., F.R.C.V.S.,
Sevenoaks.

That Graves' disease should occur in cows might have been deduced from what one knows of their general characteristics, and it is surprising that it should not have been previously described. Doubtless, this is due to the fact that one of the most prominent symptoms in cows, namely, nymphomania, is not usually recognised in human beings, whereas in cattle it dominates the clinical picture. As is usual, the dominant symptom has prevented sufficient attention to those which appeared to be of less importance, and one has, perhaps, made the mistake of viewing nymphomania from the wrong angle.

It is the purpose of this note to demonstrate that Graves' disease occurs in cows, and that nymphomania is one of its most typical symptoms. In order to substantiate a diagnosis of Graves' disease, one needs evidence of over-activity of the thyroid, and this may be derived from a study of the gland itself, as well as from symptoms.

The histological changes in the gland have yet to be worked out, and will be dealt with in a more complete subsequent communication, but the clinical picture is well known to veterinary surgeons.

The affected animal is excited, restless, and even maniacal, and these symptoms are liable to periodic exacerbation. They lose flesh and later suffer from deformities due to calcium deficiency* (the result of excessive ovarian and thyroid activity). In human beings death terminates the scene before deformities arise, and the postural factor is also wanting, since they keep at rest, but the increased excretion of calcium is a well-attested fact. The analogy remains true even if the parathyroids are responsible in each case. Still later, if the animal is allowed to live, changes sometimes occur which one recognises to be due to thyroid deficiency, and which in man are summed up under the title "Myxoedema"—a fairly frequent sequel to hyper-thyroidism.

The circulatory changes are of a similar order in man and animal. Tachycardia is an early and outstanding feature. In man the pulse is usually small and "thready" at rest, but full and "bumping" during excitement. In animals the resting pulse is less often met with. In both cases the rate is quickened throughout, but is further exaggerated by even slight stimuli of psychic or physical nature.

Again following closely the features of the disease in man, this is a disorder of thoroughbred and pedigree stock, and is less liable to affect the coarser breeds.

---

* Pugh, L. P. *Veterinary Journal*, July, 1922.

Maguire* recently ascribed nymphomania to infection of the endometrium, causing, in succession, hyperproduction of the internal secretion of the endometrium, hyperactivity of the ovaries, hyperpituitrism, hyper- or hypo-thyroidism, and hypo-parathyroidism. The writer is unable to agree with this theory, or with any others ascribing the chief source of trouble to sepsis. Uterine infection is of such very common occurrence in cattle, and nymphomania so comparatively uncommon that the presence of micro-organisms in an organ whose entrance is open and continually exposed to a rich bacterial flora, carries but little etiological importance.

It is not suggested that nymphomania is always due to Graves' disease, but only that the commonest form of nymphomania is that symptomatic of Graves' disease in the animal affected.

Since endocrine therapy has often proved disappointing, it should be embarked upon with discretion; but on the hypothesis set forth above, it is certainly well worth to give thyroid extract for the terminal myxoedematous condition. This mode of treatment has, indeed, already given good results.

For the acute stage one might venture to emphasise once again (refer to †) the sheet anchor in the human subject, namely, strict isolation from contact with other animals, and, as far as possible, rest. This, combined with treatment of the pelvic lesions, has given by far the most satisfactory results.

LABURNUM POISONING.

By W. T. HEWETSON, M.R.C.V.S.,
Brampton, Carlisle.

During the evening of March 7, 1922, I was requested to attend two crossbred Galloway cattle that had become suddenly ill. The animals were found very dull, listless, disinclined to move and standing with their heads depressed; their eyes were slightly sunk in their sockets, having a distinct rim round about them, caused by the raised appearance of the skin around the eye. The external temperature was normal, except the ears, which were cold, especially towards the tips. The internal temperature registered 103° and 104° F. The breathing in each animal was normal; the appetite was entirely lost. The most striking symptom present in each case was persistent vomiting. When either patient was pressed over the region of the rumen, a great quantity of fluid ingesta ran from the mouth and nostrils.

---

* Maguire, L. C. *Veterinary Journal*, August, 1922.
† Pugh, L. J., *V. J.*, July, 1922—Maguire, L. C., *V. J.*, August 1922.

As the above symptoms appeared at the same time in two animals grazing in the same pasture, poisoning was suspected. The owner, however, informed me that there were not any shrubs or evergreens of any kind in the pasture where the cattle had been grazing; that they were outliers, and had been in the same pasture for a considerable time.

Not then knowing the cause of the malady, the medicinal treatment adopted probably was not the best, yet it did not prove too drastic as might have been suspected it would. Both animals were taken inside and tied up in a byre, so that it would be seen what fæces each animal passed daily, and thus properly ascertain the state and condition of the bowels. Both animals were now rugged up to make them comfortable. The medicine given to each consisted of 1 lb. of mag. sulph ra, pulv. gentian rad, 1 oz., and 2 lbs. of treacle dissolved in a quart of warm water. Shortly after giving the above drench each animal received 2 ozs. of sodium bicarbonate in a pint of cold water. All food of any kind was withheld, and only aired water was offered to drink. In the morning they both received half the dose of the medicine given the night previous. The following evening I found the cattle still very dull, inclined to lie, and when down not inclined to rise readily, *i.e.*, they had to be struck with a stick before they would attempt to get up. When standing they occasionally ground their teeth and hung their heads, taking no notice of anything going on around them. Neither case had a grunt or moan, as is often met with in stomach trouble. By this time the vomition had ceased, though the medicine given had failed to open the bowels, each animal only having passed one motion in 24 hours, and this was dark in colour and dry in consistence. The owner had by this time found the cause of the complaint. Adjoining the pasture where the cattle had been going was a garden, part of the garden wall had fallen, and the owner of the garden; to stop the gap, and to prevent the cattle gaining access into his garden, cut some large branches from a laburnum tree and placed them in the opening in the wall. It was found that the cattle had eaten some of the tender shoots from these branches and also peeled off the bark from some of the thicker stems. The laburnum at this time was just beginning to shoot into bud. It was computed that the cattle would have eaten, including twigs and bark, about as much as would fill a quart measure, or about a pint each.

On learning the cause of the illness, I thought harm might have been done by giving magnesium sulphate, as the salts might prove too drastic, so now the treatment was modified, linseed oil being substituted, and 1 oz. of ammon. carb., 1 oz. of soda carb., and 1 drachm

of nux vomica pulv. was given twice daily in a quart of cold water. Of linseed oil they received 3 gills each twice daily. On the evening of the 9th the cattle were found brighter; the medicine had moved the bowels, still, the animals were not purged, but more fæces were being passed. It was thought advisable to continue giving the linseed oil, as well as the stimulating medicine twice daily. And each animal now received two quarts of milk three times a day with a pint of linseed jelly mixed in the milk. One of the animals drank this, but it had to be horned into the other.

On the 12th, the bullock that drank the milk and linseed jelly was found much duller, breathing quickly and emitting an occasional grunt or moan. This condition was thought to be due probably to the animal having chewed its cud, and thus having become re-affected with the poison. Both animals had received, up to this time, linseed oil twice daily, yet the bowels were still costive, the fæces being dry. As neither animal had gained its appetite it was thought advisable to change the medicine as the oil was considered to be the possible cause, it being somewhat sickly.

Treacle was therefore substituted in place of the oil, 3 lbs. being given to each bullock morning and night. This proved very beneficial; oil is an extremely mild laxative when given to ruminants; a large quantity has to be given before it has any action on the bowels. Treacle, on the other hand, acts more readily. The following day the animals were both much improved. The grunt and quick breathing had left the bullock that was so bad the day previous. Both animals were much brighter and took notice of things going on around them; 1 oz. of gentian pulv. was now given with the treacle twice daily. The quantity of treacle given was regulated according to the state of the bowels and quantity of fæces passed, the cattle receiving only milk, linseed jelly and scalded bran as diet, and aired water to drink, all dry food of any kind being withheld. Under the above treatment both recovered, though twelve days elapsed before they were convalescent.

This is the first case of laburnum poisoning that has come under my notice. Though from childhood we are taught that the laburnum tree is poisonous and on no account must we eat the small peas out of its pods, yet how few cases of poisoning in horses or cattle are caused by eating the laburnum compared to yew poisoning, though in many places the laburnum tree is as common and quite as accessible. It is much more poisonous than I anticipated, as the quantity eaten by these cattle was very small in comparison to the effects it produced.

AMPUTATION OF THE UTERUS OF A COW.

By R. HUDSON, F.R.C.V.S.,
Retford.

THE subject was a large Shorthorn cow, third calf, and she had calved about five or six weeks before her time. The uterus, with the placenta attached, had been everted during the night, and when found had the appearance of having been out some hours, for it was swollen, dark-coloured and dry on its upper surface.

It was washed in antiseptic solution, stripped of placenta, and well lubricated with carbolic oil and returned without much difficulty into the vagina, but all efforts to invert it through the os failed. The os had contracted up to about four or five inches in diameter, and although pressure was exerted by the hand on the womb while in the vagina, no alteration could be made; it remained as an unyielding ring through which the uterus could not pass.

Explaining the circumstances to the owner, and pointing out that he must either kill her or risk having the uterus removed, he decided on the latter, partly because she might be killed later if the operation went wrong.

A piece of clean strong cord, about twice the thickness of whipcord, was found, and the uterus having been drawn out as far as possible, it was tied tightly round the neck of the womb as high as up I could get it. Passing it round three times and tying a single knot top and bottom each time round, the owner assisting by pulling on one end, a good firm ligature was applied. The uterus was now opened to see if any intestines were included, and none being found, the amputation was performed about four inches below the ligature.

Contrary to my expectations, the cow showed no signs of shock. Throughout the day she refused all food, and at night, when the owner looked in, he found her lying on her broadside with limbs and neck rigid. She was still, but appeared to be in some pain. The next morning she took her food and was doing well. She was syringed out daily for a week with sol. acid boracic, using about two gallons. On the sixth day the ligature was found loose in the vagina and removed.

Syringing was continued while there was vaginal discharge, and in due course the cow made a splendid carcase of beef.

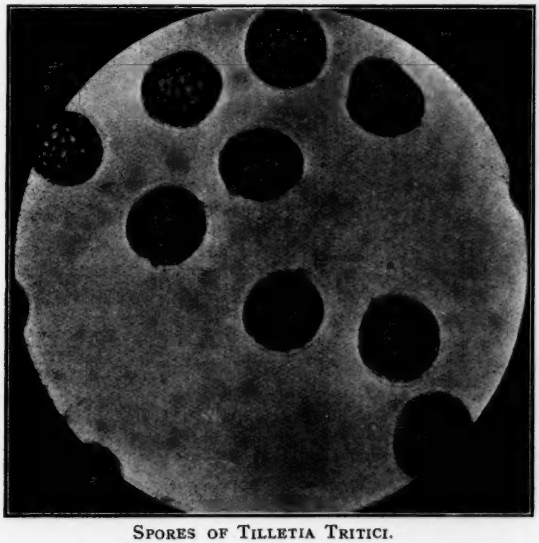
REMARKS.—I have on several occasions amputated the womb in sows, but never successfully. They have died from shock almost immediately, and it may be that this case, and others reported lately, were favourable to the operation through premature calving, the womb being smaller and containing less blood, and a lower developed nerve supply.

NOTE ON THE ASSOCIATION OF *TILLETIA TRITICI* WITH "EPILEPTIFORM CONVULSIONS" IN THE DOG.

By J. RUSSELL GREIG, M.R.C.V.S.,
Professor of Medicine, Royal (Dick) Veterinary College, Edinburgh.

CONVULSIONS of an epileptiform character are commonly met with in the dog, but their association with spores of fungi has not, so far as I know, been recorded.

Within the last eighteen months three cases, showing epileptiform symptoms, which appeared to be associated with the spores of *Tilletia tritici*, have been admitted to the hospital of the Royal (Dick) Veterinary College. The symptoms were identical in each case. The animal was suddenly attacked by a series of convulsions, which continued for some hours, and terminated in coma, in which, in two



SPORES OF TILLETIA TRITICI.

cases, death resulted; in one case recovery took place, but the animal was subsequently destroyed. As a routine measure the fæces in such cases are examined for the presence of Ascarid eggs, and in *Case A*, although no eggs of parasites were found, the fæces contained very large numbers of spores, which proved to be those of *Tilletia tritici*. An examination of the abdominal organs was made *post mortem*, but no definite abnormality was found. In *Case B* the fæces contained large numbers of the spores, which were found on post mortem to be present throughout the alimentary tract; they were also very numerous in the bile and urine, which in this case were examined microscopically.

The brain unfortunately was not examined, and no definite macroscopic lesion was discovered in any other organ.

In Case C.—Spores in large numbers were present in the intestine and urine, but no definite lesion was remarked until the cranium was opened, when an acute cerebral meningitis was presented, and smear preparations from the cerebral cortex again revealed the presence of the spores. In sections cut from brain, kidney, liver and spleen the blood vessels were seen to contain very large numbers of dark pigmented bodies; these showed much variation in size, ranging from mere particles of pigment to bodies approximating 12 μ in diameter; their nature is yet to be determined. Since the spores were so numerous in the urine it was expected that they might also be present in the blood stream. No spores have, however, been seen in sections of tissue containing blood vessels, and it is possible that these pigmented bodies may represent spores in a state of disintegration; on the other hand they may be mere artefacts. Other workers have shown by feeding experiments that the spores of *Tilletia tritici* are capable of being absorbed by the intestines and reaching such organs as kidney and liver; in one case the spores were found to have actually penetrated the placental membranes of a pregnant bitch. How an inert body, measuring about 18 μ in diameter, is capable of such absorption and penetration presents an interesting problem.

Mr. D. L. McWhirter, B.Sc., M.R.C.V.S., who has assisted me in the investigation, has examined the fæces of a number of healthy dogs and found that, although the spores of *Tilletia* are frequently present, they are by no means numerous. In many cases lengthy search was required before a single spore could be demonstrated, whereas in the fæces of affected cases commonly six and not infrequently twelve spores could be seen in a single field. *Tilletia tritici* is a normal parasite of wheat, and since wheat straw is commonly used for bedding it is possible that this is the medium of infection.

Although our material is still insufficient to permit of our arriving at any definite conclusion, it appears probable that on occasion the spores of *Tilletia tritici* may constitute a factor in the production of "epileptiform convulsions."

Further investigations are in progress, and it is hoped that a fuller report may be made later.

I have to thank Dr. Malcolm Wilson, of Edinburgh University, who kindly identified the spores, and supplied the accompanying micro-photograph.

Review.

REVIEW OF AGRICULTURAL OPERATIONS IN INDIA, 1920-1921. Published by Superintendent, Government Printing, Calcutta, India. Price 1 R. 4.

THIS review, compiled by S. Milligan, Agricultural Adviser to the Government of India, deals with agricultural conditions of the year, economic work on crops, research, and investigation, agricultural engineering, and education, co-operative movement, live stock, publications, and expenditure. The section on live stock concerns us most. There were 574 veterinary hospitals and dispensaries at work during the year, and 1,096,834 castrations were performed. Over six million cases were treated by the touring veterinary inspectors and assistants. The contagious diseases were dealt with by preventive inoculations, and 856,853 were performed. The natives in many cases hinder rather than help the work of the veterinary staff, and the latter is not strong enough in number to attend to some of the outbreaks. The Muktesar laboratory was quite busy making and supplying rinderpest, anthrax, and hemorrhagic septicæmia sera, and black quarter and hemorrhagic septicæmia vaccines. There was a welcome decrease of mortality in some of the rinderpest cases, due to the prompt reporting and quick application of inoculation and the enforcement of the segregation and cattle disease rules.

The provision of higher veterinary training for students is engaging the attention of the Government of India, and the scheme for establishing a veterinary college for the United Provinces is well advanced. Experimental work was conducted on rinderpest, bovine tuberculosis, bovine lymphangitis, equine contagious abortion, surra, mange, and spirochætosis of fowls.

Points of interest in these investigations are that "strains of tubercle bacilli infecting cattle in India possess a distinctly lower degree of virulence than t. bacilli isolated from cattle in Europe"; the tartar emetic treatment of surra in camels by Captain Cross resulted in 70 per cent. of cures (150 and 200 c.c. of a 1 per cent. solution are well tolerated, but treatment should not be commenced when trypanasomes are present in the peripheral circulation and temperature is high); spirochætosis of fowls was very effectively treated by injections of soamin (this is an organic preparation of arsenic containing 22·8 per cent. of arsenium, and is soluble in three parts of water at body temperature, and in five parts at 60° Fahr. The disease itself is said to be spread by means of the chicken tick.—*Reviewer.*)

Cattle and sheep breeding have been given attention, and there is room for well thought out policy in this connection. The grading up of the country milk breed and experiments in cross-breeding with imported cattle of high milking pedigree are two lines on which effort has been directed. A record number of bulls, viz., 239, was issued from the Hissar farm. The storage of grass and *Kadbi* (dried *juar* stalks) for use in times of famine and scarcity is a measure that is being carried out, for "the question of keeping existing cattle alive is just as important as that of maintaining and improving the breeds."

The review gives a very readable and concise account of progressive work in India, but as in the past, the thought is driven in on the reviewer, " How much to do, how few to do it." G.M.

Correspondence.

ECTOPIA CORDIS IN A BULL.

To the Editor of THE VETERINARY JOURNAL.

DEAR SIR,—I shall be glad if you will correct what is obviously an error made in my clinical note on the above in your September issue. The report of the post-mortem examination should read that the heart—which was extremely elongated and narrow—was *inside* the pericardium, and that " this extended from the maxillary region and the diaphragm, and the diaphragm was forced by the abdominal contents very far forward within about six inches of the entrance of the thorax." Since the article appeared, several calves have been born by this bull, quite normal good calves. The owner had—I think rather wittily—registered the bull as " Hartebeest."—Yours truly,

W. E. ISON, F.R.C.V.S.

ROYAL SOCIETY OF MEDICINE.

AT the opening meeting of the Section of Medicine, to be held at 5.30 p.m., October 24, at Wimpole Street, W., immediately following the address of the President (Dr. G. Newton Pitt, O.B.E., M.D.), a paper will be read by Major-General Sir John Moore, K.C.M.G., C.B., F.R.C.V.S., on " The Eradication of Glanders and Anthrax from Man and Animals." The audience will be composed of medical men and veterinarians, and it is hoped that as many as possible of the newly-elected Fellows of the Royal Society of Medicine who are Members (or Fellows) of the Royal College of Veterinary Surgeons, will attend and join in the discussion.

NOTICES.

All communications should be addressed to 8, Henrietta Street, Covent Garden, London, W.C.2. Telephone: Gerrard 4646. Telegrams; " Baillière Rand, London."

Copy or advertisements should be in the hands of the publishers—Baillière, Tindall and Cox—not later than the 25th of the month, or if proof is required not later than 23rd.

Annual Subscription, 21s. ($4.50 U.S.A. currency) post free.